RUNOFF QUANTITY ESTIMATION AT UNIVERSITY MALAYSIA PAHANG (GAMBANG CAMPUS) USING STORM WATER MANAGEMENT MODEL (SWMM)

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at University Malaysia Pahang or any other institutions.

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ABSTRAK

Dalam kajian ini, Storm Water Management Model (SWMM) digunakan untuk stimulasi kuantiti larian air di UMP Gambang semasa musim tengkujuh. SWMM adalah model yang digunakan untuk menjalankan stimulasi kuantiti larian air di kawasan bandar. SWMM boleh menjalankan koleksi kawasan tadahan air yang mempunyai intensiti hujan tinggi yang mengakibatkan larian air di kawasan yang besar yang boleh berlaku banjir. Kawasan kajian adalah di UMP Gambang sebagai kawasan tadahan dan telah dibahagikan kepada 9 kawasan tadahan. Data yang digunakan adalah data hujan dari tiga bulan iaitu dari Oktober hingga Disember 2018 yang merupakan musim tengkujuh di Pahang. Dua stesen yang berbeza digunakan iaitu dari RF3731018 (JKR Gambang) dan UMP hobo menggunakan baldi tip. Hasil daripada analisis bergantung kepada parameter yang digunakan dalam SWMM tersebut. Data dari kedua-dua stesen ini dikira berdasarkan RMSE dan RMSE terbaik adalah 3.16 m^3/s pada November 2018 berbanding 169.54 m^3/s pada bulan Oktober dan 41.39 m^3/s pada bulan Disember. Jadi, data larian air dari November dari kedua-dua stesen ini boleh digunakan untuk ramalan banjir kilat di UMP.

ABSTRACT

In this study, Storm Water Management Model (SWMM) is used to stimulate the runoff quantity at University Malaysia Pahang (UMP), Gambang Campus during the monsoon season. SWMM is model that used to run the stimulation of runoff quantity at the urban areas. SWMM can run a collection of sub catchments area that having a high intensity of rainfall that lead to the huge amount of surface runoff that can occur flash flood. The study area is in UMP Gambang as a catchment and have been divided into 9 sub catchments. The data are used in this study are three months rainfall data from October 2018 to December 2018 which are during the monsoon season in Pahang from two different station which are from RF3731018 (JKR Gambang) and UMP hobo using tipping bucket. The analysis of the result is depends on the parameter used in SWMM. The data from both station is calculated based on RMSE and best RMSE is 3.16 m^3/s on November 2018 compared to 169.54 m^3/s on October and 41.39 m^3/s in December. So, the runoff data from November from the both station can be used for prediction of flash flood at UMP.

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LIST OF SYMBOLS

JPS	Jabatan Pengairan dan Saliran
SWMM	Storm Water Management Model
RMSE	Root Mean Square Error

LIST OF ABBREVIATIONS

JPS	Jabatan Pengairan dan Saliran
SWMM	Storm Water Management Model
RMSE	Root Mean Square Error

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Urbanization is the important process in a modern world, where the population in cities and town are increase days by days. The new developments area because of the demand of population in cities and towns increase days by days. This urbanization in our country to continue more than expected. So, this urbanization has a lot of positives and negatives impact on the natural environment condition. For examples, the urbanization has a good impact on the economic situation because can improve the infrastructures and can increase the available resources at the development countries (Bustos et al., 2015). However, the negative effect of this condition has also happened. For example, it harms the environment with air pollution from the traffic (Egondi et al., 2016). Also it can cause heat stress to the people living in the cities (Derkzen et al., 2015). Lastly, urbanization changes the water balance (Paul and Meyer, 2001; Niehoff et al., 2002; Burns et al., 2005, Branger et al., 2013). The most of the problem that are occur during and after the development area had effected to the river condition based on physical, chemical and biological. This situation may be harmful if poor management and control due to the development process.

The most critical path that changes the environment condition is surfaces runoff, this condition might be happened due to imperviousness of the development such as buildings, parking lots and pavement do not allow infiltration process of the water into the ground. Research about this started around 1970, with for example Landsberg (1970), who states that the increasing imperviousness due to urbanization can causes rapid runoff.

Surfaces runoff is a major part of water because water that flow from the rain through land surface occur when more water cannot absorb to the land before it is reach

to a channel. Rapid surfaces runoff may happen if there are high demand of developments produce more impervious area and this situation may lead to the increasing amount of water and cause flash flood at the study area because of improper drainage system especially at the urban area. Besides, surface runoff can also pollute the environment of the study area because when water that flow on the impervious surfaces carried out the pollutants such as rubbish, petrol from the vehicles at parking lots , fertilizers from the garden and mini park which is flow down into the streams that can affect the water pollution. The effect of uncontrolled quantity of rainwater runoff in impervious area can also polluted the quality of surfaces runoff.

1.2 PROBLEM STATEMENT

The development in urban area have the side effects at the surrounding. The impervious area at the UMP Gambang can cause rapid surface runoff. The increase volume of surfaces runoff would allow the less water to be infiltrated into the ground and make water flow faster to downstream area that can cause the environment disaster like erosion and flash flood at the area of study.

The climate change can also effect the quantity and quality of surface runoff. During the raining season or northeast monsoon the states at east coast Malaysia such as Pahang, Terengganu and Kelantan will having the heavy rains that often can cause severe floods in this areas. Toriman et al. (2012) revealed that the rainfall intensity and runoff at north-east coastal region of Malaysia is expected to increase extremely in term of inter-annual and intra-seasonal variability in about 6% during year 2041-2050. So, with the higher rainfall intensity during this season will make the volume of surfaces runoff increase and can lead to the flood at the certain area especially at lower area and impervious area because the drainage area cannot effort the high volume of surface runoff.

1.3 STUDY OBJECTIVES

The objectives of this study are:

1. To carry out rainfall-runoff modelling using SWMM Model.
2. To determine the rainfall-runoff relationship in UMP Gambang.
3. To identify the runoff quantity of two different rain data station using Root Mean Square Error (RMSE).

1.4 SCOPE OF STUDY

The study focused on the identifying the quantity surfaces runoff at the UMP Gambang. UMP Gambang is located 30 km from the Kuantan City and the area of this campus approximately 126 acres. UMP Gambang is chosen because there are certain place at this campus will occur flash flood during the raining season. So, to determine the quantity of surface runoff during the raining season the SWMM is adapted to stimulate runoff quantity based on peak flow and runoff depth.

The SWMM model is useful tool for the various type of event based on the hydrological process including the time-varying rainfall and also use for rainfall-runoff stimulation model suitable for single event or continuous of quantity of runoff at urban area. So, based on this model the critical place that possibilities will occur flash flood will obtain.

1.5 SIGNIFICANCE OF STUDY

This study can provide the runoff, water level profile that can detect the possible area that flash flood can occur as a reference for the future. Based on this study, the relationship between rainfall and runoff also can be determined. The runoff capacity is really important to estimate the potential of flood during raining season. The research findings can be as guideline to improve the drainage system for UMP Gambang and human activities can be controlled to prevent flash flood.

The proper management for the surfaces runoff quantity and quality is very important to avoid any problem in the future such as flash flood, soil erosion and sedimentation especially during the raining season in East Coast, Malaysia. The quantity

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